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Review by: Gregory A. Bryant
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containing luciferin molecule. When the oxygen-oxygen bond is broken, the energy released yields a photon and an oxidized end product in a lower electronic energy level. The photon's color is controlled by the luciferase enzyme.

Chapter 6 describes other luminous organisms in less detail, including fireworm, ctenophore, rock boring clam, limpet, earthworm, larval glowworm, millipede, and even a glowing mushroom. Chapter 7 describes the bioluminescence in the oceans where a large percentage of animals emit light in total darkness. Chapter 8 describes the many functions of bioluminescence. They include defense such as camouflage and warning, attraction of prey, sexual communication (such as in fireflies), and enhancement of bacterial propagation. For example, the ponyfish illuminates the ventral side of its body to prevent predators from seeing it as a dark shadow blocking the daylight above. Chapter 9 explains the origin and evolution of bioluminescence. The authors provide a convincing case that bioluminescence arose to detoxify the rising atmospheric oxygen produced by photosynthesis. Nearly all luciferase enzymes are oxygenases. As an example, the luciferases of ancestral cyanobacteria have a high affinity for oxygen.

Chapter 10 covers the many uses we have adopted for the bioluminescent luciferin-luciferase reaction. For example, the addition of the cloned luciferase enzyme into a solution can detect ATP, which acts as an indicator of the presence of living organisms. Also, the gene for luciferase can be used as a reporter that, when inserted into a cell's DNA between its promoter and the gene of interest, can signal the production of a gene of interest. Also, fluorescent proteins are useful in the study of neuronal pathways. Chapter 11 describes the basic physical chemistry of how luminescence is produced in bacteria and animal cells. The final section includes a glossary, a list of further readings, the illustration credits, and an index.

The magnificent illustrations of luminescent animals photographed in their own light are what make this volume such a pleasure to read. All who do read it will realize that animal bioluminescence is ubiquitous and visually wondrous. The authors have done great justice to bioluminescence in this comprehensive and well-produced volume.

ALBERT D. CARLSON, *Editor Emeritus*, The Quarterly Review of Biology

CURIOUS BEHAVIOR: YAWNING, LAUGHING, HICCUPPING, AND BEYOND.

By Robert R. Provine. *Belknap Press, Cambridge (Massachusetts): Harvard University Press.* \$24.95. ix + 271 p.; ill.; index. ISBN: 978-0-674-04851-5. 2012.

Humans are strange animals. *Curious Behavior* by Robert Provine is an excellent survey of this strangeness. We laugh, fart, shed tears, yawn, belch, hiccup, cough, scratch, and sneeze, and do so in curiously communicative ways. As a neuroscientist and professor of psychology, Provine advocates the notion of "small science," which is the idea that many aspects of our behavior can be examined on the cheap by anyone with a penchant for observation and an investment of time. I think this undersells his research program, but I admire the spirit.

One theme Provine develops nicely is the social nature of so many unusual behaviors. Some behaviorally contagious phenomena will be familiar to most readers, such as infectious laughs and yawns, but others are less well known or understood. For example, the author describes sneezes associated with sexual desire, the increased rate of coughing during poorly rated lectures in college classes, and contralateral self-stimulation as being more ticklish because our bodies take a split second longer to identify it as the self. There is no shortage of intriguing oddities in this book, and Provine delivers it effectively for a nonspecialist audience.

Although the detailed descriptions in *Curious Behavior* are impressive, the analyses are mainly proximate, with only a few passing functional explanations for most of the curiosities. For instance, Provine never distinguishes between a signal and a cue. Given the communicative nature of many of these behaviors, this problem is not just a matter of terminology. When Provine describes the increased rate of hiccups just prior to a woman's day of ovulation as a potential "signal of fertility" he does not seem concerned about whether this is by design, or a byproduct (if true, it is obviously a cue). But this distinction will often inform questions about how a given behavior affects others, and provide explanation for its physical form. I often found myself wanting a deeper theoretical analysis to complement his extensive descriptive approach.

As a laughter researcher, I take issue with some specific points that he has made previously. For example, he states several times that people cannot laugh on command. But my own research (with C. A. Aktipis) suggests that people can produce rather genuine sounding laughs on command, with judges mistaking volitional laughter for the "real" thing almost 40% of the time—a much bigger error than Provine might expect

(G. A. Bryant and C. A. Aktipis. 2012. The animal nature of spontaneous human laughter. Paper presented at the 24th Annual Meeting of the Human Behavior and Evolution Society, Albuquerque, New Mexico). He also argues that when people laugh in conversation, there is typically nothing obviously funny causing it—this based on his own observational work. For instance, when two people say goodbye and one says, “see you later,” they both laugh out loud. What Provine fails to acknowledge is that many of the things we find funny are encrypted (T. Flamson and H. C. Barrett. 2008. *Journal of Evolutionary Psychology* 6:261–281). The reason he and his research assistants did not think others’ talk was funny is because they did not possess the necessary information to get it. I mostly agree with Provine about how laughter manifests itself, but I believe it is more tied to humor than he wants to admit.

Overall, there is much to like about this book, and the author certainly reveals the power of small science to uncover the strange nature of many of our behaviors. As he well points out, when I yawned through the whole chapter on yawning, it was not because I was bored.

GREGORY A. BRYANT, *Communication Studies and Center for Behavior, Evolution & Culture, University of California, Los Angeles, California*



NEUROBIOLOGY

ANIMAL THINKING: CONTEMPORARY ISSUES IN COMPARATIVE COGNITION. *Based on the Eighth Ernst Strüngmann Forum, held in Frankfurt am Main, Germany, 26 September–1 October 2010.*

Edited by Randolph Menzel and Julia Fischer; Program Advisory Committee: Nicola Clayton, Julia Fischer, Randolph Menzel, and Sara Shettleworth. Cambridge (Massachusetts): MIT Press. \$40.00. xi + 342 p.; ill.; subject index. ISBN: 978-0-262-01663-6. 2011.

In 1981, Donald Griffin convened a meeting of the Dahlem Konferenzen and the report he edited was published as “Animal Mind—Human Mind” (1982. Berlin (Germany): Springer Verlag). The volume was a key part of his work to establish a new field called “cognitive ethology.” In 2010, some 30 years on, the Ernst Strüngmann Forum, Dahlem’s descendant, sponsored a meeting to assess progress on the topic of animal thinking since that time. The result is this 342-page collection of 18 chapters from a broad range of behavioral researchers, some of whom are noted for perspectives almost

diametrically opposed to Griffin’s, to the credit of the organizers.

The book is separated into four sections, each reflecting a distinct research theme within animal cognition, and each consisting of three to four chapters by individual contributors or their groups that review in some detail some aspects of the theme followed by an attempted synthesis coauthored by the workshop attendees who concentrated on that theme, which often leads to important perspectives on future research directions. So there are sections on navigation, decision-making and planning, communication, and knowledge, in which the final synthesis chapter is titled Social Knowledge, indicating the particular focus that the workshop adopted under this rather broad heading. From my perspective, these syntheses vary in their success. For example, Seed et al. (Chapter 9), give a lovely survey of planning and decision-making, firmly rooted in a Darwinian perspective of optimizing costs and benefits, whereas Wiener et al. (Chapter 5) devote themselves to erecting a hierarchy of navigation “toolboxes” atop which humans perch by virtue of their symbolic map making, an approach that strikes me at least as archaic and potentially confusing—is it likely that humans evolved symbolic representations largely for their utility in navigation?

Although I am not sure it will have the same field-defining effect as Griffin’s, this book is undoubtedly cutting edge, reflecting ongoing debates within the field. It is in places highly technical, often assuming some familiarity with the concepts and terminology of specific fields; the style is also somewhat variable, reflecting the diverse range of contributions. For these reasons, I suspect that it is active researchers who will get most out of it, but whether graduate students or long-established professors, anyone working in this area will benefit from taking the time to digest the plentiful meat in this volume.

LUKE RENDELL, *Centre for Social Learning & Cognitive Evolution, School of Biology, University of St. Andrews, St. Andrews, Fife, United Kingdom*